

**FEDERAL AVIATION ADMINISTRATION
AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER**

**GROUND DELAY PROGRAM, AIRSPACE FLOW PROGRAM,
AND SUBSTITUTION MESSAGE PROCESSING**

Version 2.4

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NOTICE

This document describes functionality to be issued in ETMS release (8.2) scheduled to be deployed in April, 2006. It should not be used as a guide for how to interact with the operational ETMS prior to that date.

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1. INTRODUCTION

Ground Delay Programs (GDPs) and Ground Stops (GSes) are traffic management initiatives used to strategically manage arrivals at an airport by controlling the departure times of flights going to that airport. The programs delay departures in a manner so that the arrivals can be handled by the destination airport and airspace. A GDP is run in two cases: when the capacity of an airport is reduced, e.g., due to weather, and cannot handle the normal demand; or when the demand at an airport will be unusually high, e.g., due to a local convention, and will exceed the normal capacity.

Airspace Flow Programs (AFPs) are similar to GDPs in that they attempt to meet a desired arrival rate by controlling departure times. However, AFPs control flights arriving at a Flow Constrained Area (FCA) rather than an airport. An AFP might be used, for example, to reduce the flow rate of flights through a center when that center has reduced en route capacity due to severe weather.

A critical component of an AFP is the FCA. An FCA should be thought of as a filter for selecting a group of flights operating in the NAS. Some examples are: flights flying certain routes destined for certain airports or centers; flights traversing a center in an easterly direction; or flights traversing a particular sector. The FCA tool is extremely flexible and allows almost any set of flights to be defined. An FCA always has a physical basis, e.g., a line segment between two points, an area of airspace, a center, or a sector. The arrival rate for an AFP applies to the rate at which flights should intersect the boundary of the FCA.

GDPs, GSes, and AFPs only work if they are communicated in detail to the users, and if the users have flexibility in controlling how the program affects their operations. The substitution process provides a way for airspace users, henceforth referred to as users, to manage their flights during a GDP. Users can, for example, swap slots between a high priority flight and a less important flight, reducing the delay on one and the cost of increasing the delay for another.

There are two primary tools used by the FAA to issue and manage GDPs, GSes, and AFPs:

- Flight Schedule Monitor (FSM) – FSM is used to view airport or airspace demand, model GDPs, GSes, and AFPs, and initiate the sending of the program.
- Enhanced Traffic Management System (ETMS) – ETMS is the underlying database and communications system for traffic management. ETMS produces demand data, applies control times to the data, processes user substitutions, and generates user reports.

The main purpose of this document is to describe the formatting and usage of the various messages that are exchanged between ETMS and users during a GDP, GS, or AFP. The document attempts to provide enough background to get the novice user started, but more thorough descriptions of various GDP, GS, and AFP topics can be found at:

<http://www.fly.faa.gov/NASDOCS/nasdocs.html>.

This document is organized as follows.

Section 1 – Introduction

Section 2 – Overview of GDPs, GSes, and AFPs

Section 3 – How GDPs, GSes, and AFPs are issued

Section 4 – The usage and formatting of substitution messages

Section 5 – Requesting reports

Section 6 – Other GDP, GS, and AFP messages sent by ETMS

Section 7 – Protocol for using ARINC/ADNS or CDMNET

Section 8 – How to become a participant in the substitution process

Appendix A –Substitution error messages

2. OVERVIEW OF GDPs, GSeS, AND AFPs

The essentials of the GDP/GS/AFP/substitution process are:

- The FAA determines that a GDP, GS, or AFP is needed and models the program using FSM driven by ETMS data.
- FSM divides the airport or airspace capacity into named arrival slots that are spaced out to achieve the acceptance rate desired by the FAA. An arrival slot can be allocated for an arrival airport (GDP or GS) or for an FCA (AFP). For an FCA, the arrival slot identifies the time that flight should first cross the boundary of the FCA.
- FSM then assigns the arriving flights to the slots. FSM orders flights by the Initial Gate Time of Arrival (IGTA) and assigns exempt flights first. For each flight, FSM computes the CTD required to “hit the slot” using the current Estimated Time Enroute (ETE). [NOTE: The ETE in this context means the flying time from the departure airport to the element, i.e., airport or FCA, being controlled.] This assignment includes assigning slots to cancelled flights, thus preserving slots to which the users are entitled.
- The FAA then issues the GDP, GS, or AFP, sending the user a list of its controlled flights, the arrival slots to which they have been assigned, and the CTDs required to hit those slots.
- The user can then re-assign its controlled flights to its assigned arrival slots in a flexible manner using the substitution process.
- The user may cancel flights involved in the GDP or AFP. Cancelled flights continue to “own” slots and appear in the data, making it easy to track and swap the open slots.
- Additional data, such as the slot hold flag and Earliest Runway Time of Arrival (ERTA), can be sent to better control the effects of the GDP, GS, or AFP on the user.
- Pop-up flights, that is, flights arriving at the arrival airport or FCA during the program time interval that did not get control times in the original computation, are assigned control times as they appear. The manner as assigning delay depends on the delay assignment mode chosen for the GDP or AFP.
- FAA may choose to re-issue the GDP or AFP in several ways: e.g., compression, which fills in slots that might go unused, or revision to change parameters such as the end time or the acceptance rate.
- The process continues iteratively until such time that the program is cancelled, because it is not longer needed, or the program expires.

3. ISSUING AND MAINTAINING GDPs, GSeS, AND AFPs

3.1 Slot Lists

When a GDP, GS, or AFP is issued or revised, the user can receive *slot lists* at one or more ARINC addresses, or over the CDMNET via TCP/IP socket, or both. The slot lists provide a complete list of the controlled flights involved in the GDP, GS, or AFP for that user, including flights that have been cancelled. If the user performs substitutions for any affiliates using

different three-letter codes (e.g., if user ABC also subs for user DEF), their list will include all flights for which they can substitute. A new, complete set of lists is sent every time the FAA modifies a GDP, GS, or AFP. The user may submit substitution messages only for flights that have been issued in a slot list.

Due to line length constraints, a different slot list format is used over ARINC/ADNS than for CDMNET. The full slot list is sent over CDMNET. A shortened record is sent to ARINC/ADNS addresses.

A sample, full, CDMNET slot list for a GDP at an airport follows:

FOR LGA DESTINATION AIRPORT												
ATCSCC EDCT FLOW CONTROL DEPARTURE TIME												
ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	ERTA	IGTD	
ABC1234	LGA.260400A	DCA	LGA	260300	260400	GDP	-	-	-	260400	260245	
ABC5678	LGA.260500A	IAD	LGA	260400	260500	GDP	-	-	-	260300	260145	
ABC3601	LGA.260323A	BOS	LGA	260206	260323	GDP	Y	-	-	260319	260150	
ABC3522	LGA.260311A	DCA	LGA	260215	260311	GDP	-	-	-	260311	260145	
ABC3994	LGA.260353A	ROC	LGA	260246	260353	GDP	-	Y	-	260355	260235	

A sample, full, CDMNET slot list for an AFP for an FCA follows:

FOR FCA002												
ATCSCC EDCT FLOW CONTROL DEPARTURE TIME												
ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	EENTRY	IGTD	
ABC1234	FCA002.260400A	DCA	LGA	260300	260400	AFP	-	-	-	260400	260245	
ABC5678	FCA002.260500A	IAD	BOS	260400	260500	AFP	-	-	-	260300	260145	
ABC3601	FCA002.260323A	BOS	LGA	260206	260323	AFP	Y	-	-	260319	260150	
ABC3522	FCA002.260311A	DCA	BOS	260215	260311	AFP	-	-	-	260311	260145	
ABC3994	FCA002.260353A	ROC	LGA	260246	260353	AFP	-	Y	-	260355	260235	

Following is a description of the data in the full slot list.

Line 1: Identifies the GDP airport (LGA) or the AFP FCA (FCA002).

Line 2: Identifies the data as flow control departure times.

Lines 3 – n: A line for each controlled flight. For each flight, the slot list provides:

Field 1: Flight ID (e.g., ABC1234, N750CC). Flight identifier as it appears or will appear on the NAS flight plan.

Field 2: Arrival Slot; the time slot that has been reserved at the airport or FCA for this flight to arrive (e.g., LGA.260400A, FCA002.260400A). The format is a concatenation of airport or FCA name, slot date and time, and a one-letter suffix. An airport name can be three or four characters. An FCA name must be the letters “FCA” followed by three digits. The name is separated from the date time by a dot for readability. The slot date and time is six digits: two each for day, hour, and minute. Day, hour, or minute should be zero padded if necessary (e.g., 06). The suffix letter is used to ensure that slot name is unique.

Field 3: Departure Airport (e.g., DCA)

Field 4: Arrival Airport (e.g., LGA). [Note: For a GDP, the arrival airport will be the same for every flight; for an AFP, they may differ.]

Field 5: Controlled Time of Departure (CTD); the time the flight should take off (e.g., 260300). The format is a concatenation of day-hour-minute.

Field 6: Controlled Time of Arrival (CTA); the time the flight should arrive at the controlled airport or FCA (e.g., 260400). The format is a concatenation of day-hour-minute.

Field 7: Control Type; the source of the current control times for this flight (e.g. GDP). The control types that can appear in a slot list are:

GDP – Control times were computed as part of an initial GDP, a revision to a GDP, or an extension to a GDP.

AFP – Control times were computed as part of an initial AFP, a revision to a AFP, or an extension to a AFP.

COMP – Control times were computed by compression.

BLKT – Control times were computed by a blanket program.

GS – Control times were computed by a ground stop.

SUB – Control times were assigned by a conventional user substitution message.

SCS – Control times were assigned by a user slot credit substitution message.

BRG – Control times were assigned when creating a bridge for an SCS or ECR request.

ECR – Control times were assigned by an FAA ECR request.

DAS – Control times are from an DAS delay being assigned to a pop-up flight.

GAAP – Control times are from an unassigned slot being assigned to a pop-up flight.

UPD – Control times are from an FAA “EDCT UPDATE” command.

RCTL – Control times are from a DAS delay but the flight is a re-controlled flight from a purged AFP or GDP and therefore has full subbing rights.

Field 8: Exempt Flag; indicates the flight was exempt from delays when the GDP or AFP was computed. Format is “Y” if true, “-“ if false.

Field 9: Cancel Flag; indicates whether the flight is currently cancelled. Format is “Y” if true, “-“ if false.

Field 10: Slot Hold Flag; indicates whether a slot belonging to a cancelled flight is being held by the user for substitution. Format is “Y” if true, “-“ if false.

Field 11: Earliest Runway Time of Arrival (ERTA) or Earliest Entry Time (EENTRY): the earliest time flight can arrive at the controlled airport element in the case that the delays are reduced (e.g., 260200). ERTA will be included for a GDP; EENTRY for an AFP.

Field 12: Initial Gate Time of Departure (IGTD); the original scheduled gate push back time for the flight (e.g., 260245). Used to uniquely identify the flight.

A sample, truncated, ARINC/ADNS slot list for a GDP at an airport follows:

FOR LGA DESTINATION AIRPORT									
ATCSCC EDCT FLOW CONTROL DEPARTURE TIME									
ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	IGTD
ABC1234	LGA.260400A	DCA	LGA	260300	260400	GDP	-	-	260245
ABC5678	LGA.260500A	IAD	LGA	260400	260500	GDP	-	-	260145
ABC3601	LGA.260323A	BOS	LGA	260206	260323	GDP	Y	-	260150
ABC3522	LGA.260311A	DCA	LGA	260215	260311	GDP	-	-	260145
ABC3994	LGA.260353A	ROC	LGA	260246	260353	GDP	-	Y	260235

A sample, truncated, ARINC/ADNS slot list for an AFP for an FCA follows:

FOR FCA002									
ATCSCC EDCT FLOW CONTROL DEPARTURE TIME									
ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	IGTD
ABC1234	FCA002.260400A	DCA	LGA	260300	260400	AFP	-	-	260245
ABC5678	FCA002.260500A	IAD	BOS	260400	260500	AFP	-	-	260145
ABC3601	FCA002.260323A	BOS	LGA	260206	260323	AFP	Y	-	260150
ABC3522	FCA002.260311A	DCA	BOS	260215	260311	AFP	-	-	260145
ABC3994	FCA002.260353A	ROC	LGA	260246	260353	AFP	-	Y	260235

The meaning of the fields is the same as for the full list.

A user can request a current slot list at any time over ARINC/ADNS or the CDMNET. The requested list will show the state of the data at the time of the request; that is, it will include the latest times as a result of substitutions and other changes. The format of the requested slot list is the same as the issued slot list except for differences in the header. The report request/reply is described in Chapter 6.

3.2 Unsolicited Messages

Once a GDP, GS, or AFP is in place, control times can change and new flights can appear. Whenever there is a change to a flight that is not in response to a substitution request by the responsible user, a message is sent out to the user notifying them of the update. These messages, known as unsolicited messages, also use the slot list data format. They can be programmed to go either to ARINC addresses or over the CDMNET. Chapter 7 describes the unsolicited messages.

3.3 Delay Computation for Pop-ups

A pop-up flight is defined as a flight that is planned to arrive during the time period of a GDP or AFP, but which did not exist when the GDP or AFP was issued. Pop-up flights are generally created from a flight plan that is filed after the GDP or AFP was sent. Some examples of pop-up flights are:

- A flight plan filed for a flight that did not exist at all in the ETMS database when the GDP or AFP was computed.
- A flight plan filed for an existing flight that takes it through an FCA that has an AFP, whereas the previous route did not take that flight through the FCA.
- A flight that was exempt from an AFP because it was in a GDP, but now the GDP is purged.

Special mechanisms have been built for assigning control times to pop-up flights. The mechanism used is determined by the delay assignment mode chosen by the FAA when the GDP or AFP was issued. The choice of mechanism can affect whether the user can substitute that flight. The two

choices are *DAS Mode* and *GAAP Mode*. The substitution processing for pop-ups is described in section 4.1.8.

DAS Mode

The default mode for a GDP or AFP is Delay Assignment (DAS) mode. When DAS mode is selected, ETMS assigns equitable delays to the pop-up flights regardless of whether there is available capacity at the resulting arrival time. The equitable delay is, roughly speaking, the average delay that was assigned to known flights wanting to arrive during the same 15-minute interval as the pop-up. A pop-up flight that is new to the database is identified in a slot list by having a control type of “DAS”. A pop-up flight that is due to another program being purged or a flight routing from one AFP to another is identified in a slot list by having a control type of “RCTL”. (NOTE: A DAS flight has subbing restrictions while a RCTL flight can be subbed fully. See section 4.1.8 for details.)

GAAP Mode

The other alternative is GAAP mode. GAAP mode is used when the demand does not exceed the capacity at the time the GDP or AFP is computed, but is expected to exceed the capacity later due to a large number of expected pop-ups. (The pop-ups are sometimes GA traffic, leading to the phrase GA Arrival Program, leading the name GAAP.) In GAAP mode, there are open slots at the time the GDP or AFP is computed; these are referred to as *unassigned slots*. When a pop-up appears, it will get the first available unassigned slot at or after its desired arrival time. If a slot is available, it is assigned to the flight, an appropriate CTD and CTA are computed, and the control type is set to “GAAP”.

To ensure that the assigned delays do not get too large, the search for an unassigned slot stops when the delay reaches a *delay limit*. If the search hits the delay limit, the flight is treated as if in DAS mode with the assigned delay being equal to the delay limit. In this case, the control type will be “DAS” and the flight is restricted for subbing, as described in the above section titled *DAS Mode*.

3.4 Precedence of GDPs and AFPs

If an AFP or GDP is issued at the same time that a GDP or another AFP is in effect, it is possible that it could include a flight that has already been controlled by the existing GDP or AFP. For example, a flight destined for EWR could be controlled by an AFP over ZOB, then a GDP could be issued for EWR. In this case, the FAA will determine whether the new AFP or GDP should have precedence over the old. The precedence rules are as follows:

- A GDP will always have precedence over any AFP no matter what order they are issued. (Note: A flight can only be affected by one GDP at a time, as it can have only one destination.)
- An AFP will normally exclude flights that were controlled by a previous AFP.
- The FAA will have the option, if needed, to issue an AFP that overrides previous AFPs.

The user will know the precedence for a flight by examination of the slot list. Assume there is a flight that has already been controlled and is a candidate to be part of a new AFP or GDP. When the new slot list is issued, it will either include this flight or not. If it includes the flight, it means that the new AFP or GDP has been given precedence over the previous AFP. If it does not include the flight, it means that the previously issued controls still apply to that flight. If the new slot list includes the flight, the user should conclude that the previous control data is now void and has been replaced by the new control data. The important points to note are:

- A flight can only be controlled by one GDP or AFP at a time
- The controlling element (i.e., the airport or FCA for which the program was issued) may change.

As a result of the above, it is important to monitor what the controlling element is for a flight. This can be detected in two ways:

- Any message sent with control times will include the name of the controlling element in the first line of the header; for example: “DAS DELAY FOR LGA” or “DAS DELAY FOR FCA002”.
- The assigned slot for each flight includes the name of the controlling element; for example, LGA.061745A or FCA002.281745B.

4. USER SUBSTITUTIONS

Substitution messages allow a user to trade arrival slots between their flights, including cancelled flights. Substitutions allow a user to reduce delay for a high priority flights at the expense of more delay for another flight, or to cancel a flight and reduce delay for a number of other flights.

Requests for substitution processing must be transmitted over ARINC/ADNS to the Air Traffic Control System Command Center (ATCSCC) ARINC address TFMBSYA or over the CDMNET via TCP/IP socket. The format of the SS message is the same regardless of how the message is transmitted.

As an introduction, this section first presents an example of a substitution (SS) message. Each part of the message, including the detailed message formats and field descriptions is then described in more detail.

A sample SS message for a GDP has the following format:

```
SS ABC0626021029.01
FX ABC1234 DCA LGA 06260145
FM ABC1234 DCA LGA 06260145 T5 260400 T6 260500 A2 LGA.260500A
FM ABC5678 IAD LGA 06260245 T5 260300 T6 260400 A2 LGA.260400A
```

The sample SS message could be issued as a response to the slot list shown in section 1, and operates on the first two flights shown in that list. The effect of this example is to cancel flight ABC1234 and swap the arrival slots between ABC1234 and ABC5678. More specifically:

The first line identifies this as a substitution (SS) packet sent by user ABC on June 26th at 02:10:09Z. (The “.01” can be set to whatever the user wishes.)

The “FX” line cancels flight ABC1234 from DCA to LGA originally departing on June 26th at 0145Z (06260145).

The first “FM” line says that flight ABC1234 from DCA to LGA originally departing on Jun 26th at 0145Z (06260145) wants a new a CTD (T5) of 0400Z on the 26th (260400), CTA (T6) of 0500Z on the 26th (260500), and the arrival slot (A2) “LGA.260500A”.

The second “FM” line says that flight ABC5678 from IAD to LGA originally departing on Jun 26th at 0245Z (06260245) wants a new a CTD (T5) of 0300Z on the 26th (260300), CTA (T6) of 0400Z on the 26th (260400), and the arrival slot (A2) “LGA.260400A”.

The net effect is the flight 1234 is cancelled and flight 5678 has a one-hour delay reduction.

An SS message for an AFP has the same format, as seen in the following sample:

```
SS ABC0626021029.01
FX ABC1234 DCA LGA 06260145
FM ABC1234 DCA LGA 06260145 T5 260400 T6 260500 A2 FCA002.260500A
FM ABC5678 IAD BOS 06260245 T5 260300 T6 260400 A2 FCA002.260400A
```

A more formal description of the SS packet format follows.

Line 1: Packet header. The letters “SS” followed by a space followed by a unique packet identifier. The packet identifier shall consist of the three-letter user code, a ten-digit transmission date/time (two digits each of month, day, hour, minute, second), a period (“.”), and a two-digit suffix. The two-digit suffix may be used to create unique identifiers when multiple messages are generated in the same second. Otherwise the user can set the suffix to any desired two digits.

NOTE: If the packet is sent over the CDMNET, the user has the option of directing the reply to an ARINC/ADNS address instead of back to the sending client via TCP/IP socket. To do so, the desired ARINC address must be included following the packet identifier separated by a space. Example: SS ABC0626021029.01 SUBHQAB

Lines 2 – n: Substitution messages. Possible message types are:

FM – Flight modify message; updates one or more data fields for the flight identified in the message. Used to reassign an already controlled flight to a new arrival slot.

FX – Flight cancel message; cancels the flight identified in the message. Used to cancel a controlled flight.

SCS – Slot Credit Substitution message; conditionally exchanges a slot that a flight cannot use for a slot the flight can use. Only has an effect if ETMS is able to swap the existing slot to a new, usable time range.

SC – Slot create message; creates an arrival slot for the flight identified in the message. Used to assign control times to a flight that is not already controlled when a user wants to restore the schedule order between a controlled and non-controlled flight.

HOLD ALL SLOTS – Sets the hold flag for all flights belonging to the sending user that are currently controlled and cancelled. Used to preserve the position of all a user’s open slots during the next compression.

RELEASE ALL SLOTS – Releases the hold flag for all flights belonging to the sending user that are currently controlled and cancelled. Used to tell ETMS to make maximum use of all of a user’s open slots during the next compression.

The format for each of these is described in section 4.2.

4.1 Substitution Message Usage

The messages within the substitution (SS) packet are used to re-assign flights to slots, to update other data about controlled flights, to cancel flights, manage open slots, and to create slots for uncontrolled flights.

The following sections describe how the messages are used for each of these functions. Additional sections describe unique restrictions in substituting “pop-up” flights, and error checking.

4.1.1 Re-assigning Flights to Slots

The main task of substitutions is to re-assign flights to slots; that is, move one or more flights later in order to decrease the delay on one or more other flights. Re-assigning flights to slots is

accomplished by sending a set of FM messages. Each FM identifies the flight and the new slot requested for the flight. The slot assignments in a single SS packet are error checked both individually and as a group. If any errors are discovered in the packet, the entire packet is rejected and no changes are committed to the ETMS database. The main point of the error checking is to see that the one-flight-one-slot rule is preserved. That is, a sub packet contains N flights that are currently assigned to N slots. After the packet is processed, those N flights must still be assigned to those same N slots, although in a different order. More details on the error checking are provided in section 4.1.8.

An FM message must provide the following data:

- A unique identification of the flight (flight ID, origin, destination, and original gate departure date and time).
- The arrival slot desired for that flight.
- The new CTD and CTA for the flight to make that arrival slot.

NOTE: Cancelled flights can be re-assigned just like any other flight.

The format of the FM message is described in detail in section 4.2.1

4.1.2 Updating Other Data About a Controlled Flight.

Changes to a controlled flight's data other than the control times and assigned arrival slot are also sent in FM messages. These changes may be coupled with the control time changes in an SS packet, or sent independently in a flight data (FD) packet. Data field changes that are specifically relevant to the GDP are:

- For a cancelled flight, the user can use an FM to change the value of the slot hold flag. The slot hold flag tells FSM whether an open slot should be automatically filled when the GDP is compressed or revised.
- For a non-cancelled flight, the user can use an FM to modify the Earliest Runway Time of Arrival (ERTA). The ERTA tells FSM the earliest possible arrival time the flight can make in the event that delays are reduced.

The format of the FM message is described in detail in section 4.2.1

4.1.3 Cancelling Flights

A user can cancel a controlled flight using an FX message. Once the flight is cancelled, the user can continue to substitute that flight like any other flight. Also, the cancelled flight continues to appear in the slot list with its current assigned slot. This provides an easy and robust mechanism for tracking and managing open slots.

An FX message must provide a unique identification of the flight (flight ID, origin, destination, and original gate departure date and time). An FX may also optionally set the value of the hold flag (the use of the hold flag is described in section 4.1.6).

An FX message is subjected to the following checks:

- The user must be authorized to cancel the flight, as determined by the sending ARINC or CDMNET address.
- The flight must have appeared in a slot list issued by FAA or have been controlled by the user using a Slot Create message.
- The flight must not be active (airborne) or completed.

- The flight must not be already cancelled.

The format of the FX message is described in detail in section 4.2.2

4.1.4 Drop-out Flights

For an AFP, an open slot can be created in another way: a flight might change its route so that it no longer travels through the FCA or an FCA might be edited so that a flight no longer meets the FCA definition. Such a flight is referred to as a drop-out. In this case, ETMS considers the flight to be no longer controlled and cancels the EDCT for the flight. The flight also loses its slot in the AFP, will no longer appear in any slot list for that AFP, and can no longer be substituted as part of that AFP. In the case of a reroute, if the user wishes to obtain any benefit from the slot for the rerouted flight, they should submit substitutions for that flight prior to rerouting it out of the FCA.

Several notes about drop-out flights:

- There is no way for the user to indicate that a flight has rerouted out of an FCA through a substitution message. The user can only do so by filing a new flight plan or submitting an early intent flight plan.
- Once a flight has dropped out of an FCA, the user will get an unsolicited message from ETMS telling them that the flight is no longer controlled. This message is described in section 7.9.
- The flight will not appear in subsequent slot lists for that AFP.

There is one exception to the above discussion. If a flight drops out of one AFP, it might become eligible for another AFP. In this case, the control for that flight will be transferred to the new AFP and new control data, including a CTD, CTA and ASLOT, will be assigned. The slot from the original AFP will be lost. The user will first be notified that the flight is not controlled by the original AFP, as described in section 7.9, then will be notified of the new control data through a RECONTROL message, which is described in section 7.10.

NOTE: To avoid unfairly penalizing or rewarding a re-controlled flight, the subbing status will be preserved from the previous program. That is, if the flight could be subbed in the previous program, it can still be subbed. If the flight was a pop-up in the previous program, it cannot be subbed. If the flight can be subbed, it will appear in the slot lists with a new control type of RCTL (re-control).

4.1.5 Slot Credit Substitutions

It is common that a slot is open due to the flight in that slot being either cancelled or delayed. In many cases, the user has another flight it can swap into that slot using a normal substitution message, as described in section 4.1.1.

Sometimes, though, the user may not have a flight that can move early enough to use the open slot. If the FAA runs compression, other flights will be moved up into the open slot, if possible, to move the open slot down to a time that the owner of the slot can use. However, this leaves the user unsure whether that open slot will ever be used. This creates unnecessary delays, and in the worst case might motivate a user not to cancel a flight because they are not sure they will get any benefit.

Slot Credit Substitutions (SCS) provide a mechanism for a user to substitute in these situations by using other users' flights to bridge the open slot from an unusable time to a time that can be used to the requester's advantage. The general concept of an SCS is as follows:

1. A GDP or AFP is in place.

2. A user identifies an opportunity where they already have an open slot at time t_0 due to delay or cancellation, or could create an open slot at time t_0 by canceling a flight (f_0), but cannot move another flight directly into that slot using a normal substitution.
3. The user identifies a flight (f_1) that they would like to move up, and determines the time range (from t_1 to t_2) in which they would like flight f_1 to arrive.
4. The user submits a sub message that says: "I will yield my slot at time t_0 to the system if I can move flight f_1 up into a slot sometime from t_1 to t_2 ." The requested time range must be later than the slot being yielded.
5. ETMS examines all the available flights in the time range t_0 to t_2 to see whether it can create a bridge from the time that the user is yielding (t_0) to a time that the user can use (somewhere from t_1 to t_2). That is, ETMS tries to move other users' flights earlier to get a later slot time for the requesting user.
6. If a bridge is available, ETMS:
 - Selects one or more flights to be the bridging flights and moves them up into to new slots, thus reducing their delay.
 - Assigns the resulting opened slot to flight f_1 .
 - Updates the ETMS databases to reflect the bridging subs as well as the SCS.
 - Sends a reply to the requesting user with the updated slot list for its flights.
 - Sends a message to any other users whose flights were used in the bridge to notify them of the changes to their control times.
7. If a bridge is not available, ETMS rejects the SCS and sends a suitable error message (NO SLOTS AVAILABLE) back to the requesting user.

A ramification of an SCS message is that any user's flights can get moved as part of a bridge at any time. This has two implications:

1. Users must constantly monitor the unsolicited messages to find out about any delay reductions.
2. If the change occurred while the user was preparing a substitution, it could be disruptive to that user. Therefore, two new messages were introduced to allow a user to temporarily disable the use of their flights as bridging flights. These messages are BRIDGING OFF and BRIDGING ON.

The format of the SCS message is described in section 4.2.3. BRIDGING ON and BRIDGING OFF are described in sections 4.2.7 and 4.2.8.

4.1.6 Managing Open Slots: The Hold Flag

When a controlled flight is cancelled, the slot to which it is assigned is known as an *open slot*. Also, if a flight diverts away from the controlled airport during a GDP, an open slot is created. In general, the user who operates that flight has ownership of the open slot and can use it to substitute, and reduce delays for, other flight. Every effort must be made to ensure that no open slot go unused during a GDP or AFP.

Responsibility for using open slots goes to both the users and the FAA. The user can use an open slot by sending in substitutions that move other flights to earlier slots and move the open slot to late in the program where it has little or no value. The FAA can use open slots by running compression or revising the GDP or AFP. In either case, FSM identifies open slots and attempts

to move them to the end of the program in order to reduce delays both for the owner of the slot and for other users.

NOTE: The compression algorithm is carefully designed to ensure that the user that owns the open slot gets the maximum possible delay reduction from that slot. That is, if compression can move the open slot to the end of the GDP or AFP by only moving up flights belonging to that user, it will. Only in the event that the owning user has no flights that can use the open slot will the compression algorithm assign another user's flight to the open slot.

Compression or revision will only move an open slot if the slot has been *released* by the user. When a user cancels a flight, it has the option of explicitly holding or releasing the slot (the slot is released by default). When a flight is diverted, the slot is automatically released, although the user can hold the slot by sending an additional message. If the user holds the slot, the user is saying that it will take responsibility for moving other flights up into that slot, and moving the open slot down to the end of the GDP or AFP. If the user releases the slot, it is saying that the slot is free for the FAA to manage.

In order to help ensure that open slots do not go unused, slots are automatically released each time a GDP or AFP is compressed or revised. That is, when a user holds a slot, that hold is good only for the next compression or revision. This makes it less likely that a user will hold an open slot then forget to ever use it.

A sample sequence of how the slot holding works is as follows:

- A GDP is issued
- User cancels a flight and holds the slot.
- User performs some substitutions moving the open slot to later in the GDP.
- FAA compresses the GDP. The open slot stays where it is, but it is released; i.e., no longer held.
- User continues to substitute flights using the open slot.
- FAA compresses the GDP again. Now the open slot, which is released, is compressed down to the end of the GDP.

At any time when a user is done doing substitutions and wishes to make all its open slots available for general use, the user can issue the "RELEASE ALL SLOTS" message. This has the effect of clearing the slot hold flag for all cancelled flights for the sending user. The format of the RELEASE ALL SLOTS message is described in detail in section 4.2.5.

When compression is imminent and a user needs more time to complete its substitutions, the user can preserve the position of all its open slots by issuing the "HOLD ALL SLOTS" message. This has the effect of setting the slot hold flag for all cancelled flights for the sending user. The format of the HOLD ALL SLOTS message is described in detail in section 4.2.4.

The setting of the hold flag for an individual flight using an FM message is describe in section 4.2.1. The setting of the hold flag when canceling a flight with an FX message is described in section 4.2.2.

4.1.7 Creating Slots for Uncontrolled Flights

Due to the nature of the GDP and AFP algorithms and procedures, a situation can arise where a user is forced to operate scheduled flights out of order. Consider an example of a user that runs hourly service from BOS to IAD on the half hour. Consider two of these flights:

FLIGHT1 normally departs at 1430Z

FLIGHT2 normally departs at 1530Z

A GDP is issued for IAD with an end time of 1500Z. The delays are running approximately 2 hours. After the GDP is issued, FLIGHT1 has a CTD of 1630Z. Assuming the GDP is not extended, FLIGHT2 can operate on time, while FLIGHT1 has to operate an hour after FLIGHT2. Since FLIGHT2 is not controlled and has no arrival slot, the user cannot swap these two flights and put them back into the scheduled order with one-hour delay for each flight.

The Slot Create (SC) message allows a user to manage this scenario. Using slot create, the user can voluntarily control FLIGHT2, creating an arrival slot for it at its normally planned arrival time. Once the slot is created, the user can swap the two flights using the usual mechanisms described in 4.1.1.

When a user creates an arrival slot for an uncontrolled flight, the user must provide:

- A unique identification of the flight (flight ID, origin, destination, and original gate departure date and time).
- The arrival slot desired for that flight.
- The new CTD and CTA for the flight to make that arrival slot.

The Slot Create message is subjected to the following special error checks in addition to those described in section 4.1.8.

- The flight cannot already be controlled.
- The arrival slot name cannot already exist.
- The new CTA must be the same as the arrival slot time.

The format of the SC message is described in detail in section 4.2.3

4.1.8 *Substituting Pop-up Flights*

A pop-up flight is defined as a flight that is planned to arrive during the time period of a GDP or AFP, but which did not exist when the GDP or AFP was issued. The delay computation for pop-up flights is described in section 3.3 and varies depending on how the GDP or AFP was issued. The choice of mechanism can affect whether the user can substitute that flight. The two choices are *DAS Mode* and *GAAP Mode*.

DAS Mode

When a flight gets a DAS delay, it does not have a legitimate slot. As a result, no substitutions are generally allowed for pop-up flights. Pop-up flights are identified in a slot list by having a control type of "DAS".

The sole exception to this is when a flight is re-controlled; that is, a flight is in one AFP or GDP, becomes no longer controlled, perhaps due to that AFP or GDP being purged, and is now eligible for control in another AFP. In this case, the flight maintains the subbing status that it had in the previous AFP or GDP. If the flight was a pop-up in the prior AFP or GDP, it will still be considered a pop-up and cannot be used for substitutions. If the flight could be subbed in the prior GDP or AFP, it can be subbed in the new AFP; in this case, the control type will be "RCTL" (re-control) to indicate that it is not a normal pop-up.

A more complicated case occurs once the GDP or AFP is compressed or revised. When the FAA compresses or revises, arrival slots are assigned to the pop-up flights. This enables substitutions for these flights. However, to reduce the opportunities for a user to take unfair advantage of the

system, an additional restriction has been placed on substituting these *former pop-up* flights. A user can use substitution messages to move a former pop-up flight earlier in time. However, a user cannot use a slot belonging to a former pop-up flight to move another flight earlier in time.

Consider the following example:

<u>Flight</u>	<u>Status</u>	<u>Slot Time</u>
ABC111	Normal	1200Z
ABC222	Former pop-up	1230Z
ABC333	Normal	1300Z

The user operating these flights can swap the slots between ABC111 and ABC222, moving the former pop-up flight earlier in time. However, the user cannot swap flights ABC222 and ABC333, using the former pop-up slot to reduce the delay for another flight.

An important distinction must be made between “pop-up” and “re-controlled” flights. A pop-up flight did not exist at the time a GDP or AFP was computed. A “recontrolled” flight did exist, but was not considered to be part of the AFP because it was part of a GDP or a different AFP. If the flight becomes eligible for an AFP due to another program being purged, or due to its route moving it from one AFP to another, the flight is not considered a pop-up. ETMS assigns an average delay to the flight, as for a pop-up, but gives it a control type of “RCTL” rather than “DAS”. A “RCTL” flight can be subbed with no restrictions. Only a “DAS” flight is restricted as described in this section.

GAAP Mode

In GAAP mode, if a slot is available, it is assigned to the flight, an appropriate CTD and CTA are computed, and the control type is set to “GAAP”. In this case, the flight has a legitimate slot and so has full substitution rights. If no open slot can be found, the flight gets a DAS-like delay and has a control type of “DAS”. In this case, the flight is subject to the same limitations as any other DAS-mode pop-up.

4.1.9 Error Processing

When an SS packet is processed, the messages are error checked both individually and collectively. Collective checking is required to ensure that the one-flight-one-slot rule is preserved. If any error is discovered during the processing of a packet, the entire packet is rejected without making any updates to the ETMS database. This avoids the situation where the user is unsure of what changes did or did not get applied, or creating an unwanted set of changes, or in the case of an SCS, applying some changes although an SCS message is rejected.

Because packet-level error checking is performed, all messages in an SS packet must pertain to the same GDP or AFP. This simplifies both the generation of the messages and the error checking.

ETMS tries to find as many errors as possible when a packet is processed. If a packet is rejected, all detected errors will be reported in the reply.

A potential source of errors is lack of synchronization between the user data and the ETMS data. A report – EDCT SLIST – has been provided to allow a user to request the entire ETMS data for a GDP whenever a “re-synch” is desired.

A complete list of the possible error messages is provided in Appendix A.

The flight-specific error checks are as follows:

- The user must be authorized to modify all flights in the packet, as determined by the sending ARINC or CDMNET address. A user is authorized to modify its own flights and

sometimes those of affiliated “sub-carriers”. The authorization may be defined in several ways.

- A user may be authorized to sub any flight for a certain three-letter code (e.g., all AAL flights).
- A user may be authorized to sub flights for a certain three-letter code in a specified time range (e.g., ASH flights from 1000 to 1999).
- A user may be authorized to sub flights in a list of specific flight IDs (e.g., N123CD, N750CC, ...)
- All slots specifically identified in the packet must have previously been assigned to the user by ETMS in a slot list or unsolicited updates, or created by the user via a valid Slot Create message.
- Each flight must have appeared in a slot list or unsolicited update issued by ETMS, or have been controlled by the user using a Slot Create message.
- All flights in a sub packet must be controlled by the same GDP or AFP. You cannot swap slots between a flight in an AFP and a flight in a GDP, or between flights in two different AFPs.
- An SS packet must preserve the one-flight-one-slot relationship. That is, after the SS packet is processed, every slot contained in the packet must have exactly one flight in it and every flight in the packet must be assigned to exactly one slot.
- The ETE for each flight, as computed by subtracting the CTD from the CTA, may change from the previous ETE by no more than 45 minutes or 50% of the previous ETE, whichever is greater. That is:
 - If the previous ETE was from 1 to 90 minutes, the new ETE may change by up to 45 minutes.
 - If the previous ETE was greater than 90 minutes, the new ETE may change by up to 50% of the previous ETE.

NOTE: The ETE used for this check is the flying time from the departure airport to the controlled element. For a GDP, the controlled element is the arrival airport, so the ETE corresponds to the conventional notion. For an AFP, the ETE used for the error check does not correspond to the entire flying time.

- The new CTA for each flight must be no earlier than the arrival slot time, and no more than 20 minutes later than the arrival slot time.

4.2 Substitution Message Formats

4.2.1 FM Message

The FM message is used to modify data about an existing controlled flight. The first field defines the message type. The next four fields uniquely identify the flight that is being modified. The remaining fields are used to modify the data for the flight. For each field being modified there is a field identifier followed by the new data value for that field.

A sample FM message for a GDP has the following format:

```
FM ABC1234 DCA LGA 06260145 T5 260400 T6 260500 A2 LGA.260500A -  
A6 R T8 260430
```

The sample message has the following meaning:

- FM – Message type. (Required)
- ABC1234 – Flight identifier (a.k.a. call sign) of the flight being modified. (Required)
- DCA – Origin airport for the flight. (Required)
- LGA – Destination airport for the flight. (Required)
- 06260145 – Original gate departure date and time for the flight (0145Z on June 26th). (Required)
- T5 – Field identifier for CTD.
- 260400 – New value of CTD requested for this flight (0400Z on the 26th). (Required)
- T6 – Field identifier for CTA.
- 260500 – New value of CTA requested for this flight (0500Z on the 26th). (Required)
- A2 – Field identifier for assigned arrival slot. (Required)
- LGA.260500A – Name of arrival slot requested for this flight. (Required)
- “-“ – Continuation character; indicates that the message continues on the next line.
- A6 – Field identifier for slot hold flag. (Optional)
- R – New value (released) requested for this flight’s slot. (Optional)
- T8 – Field identifier for ERTA. (Optional)
- 260430 – New value for the ERTA for this flight. (Optional)

A sample FM message for an AFP has the following format:

```
FM ABC1234 DCA LGA 06260145 T5 260400 T6 260500 A2 FCA002.260500A -  
A6 R T8 260430
```

A detailed description of each field format is provided in section 4.2.9.

4.2.2 FX Message

The FX message is used to cancel an existing controlled flight. The first field defines the message type. The next four fields uniquely identify the flight that is being modified. The user can optionally send an additional two fields for setting the value of the hold flag.

A sample FX message has the following format:

```
FX ABC1234 DCA LGA 06260145 A6 H
```

The sample message has the following meaning:

- FX – Message type. (Required)
- ABC1234 – Flight identifier (a.k.a. call sign) of the flight being modified. (Required)
- DCA – Origin airport for the flight. (Required)
- LGA – Destination airport for the flight. (Required)
- 06260145 – Original gate departure date and time for the flight (0145Z on June 26th). (Required)
- A6 – Field identifier for slot hold flag. (Optional)

H – New value (held) requested for this flight’s slot. (Required)

A detailed description of each field format is provided in section 4.2.9.

4.2.3 SCS Message

The SCS message is used to exchange a slot that cannot be used for a slot that can be used. The SCS message differs from the other flight specific messages in that it is about specific slots more than specific flights. However, since the message formatting and error checking in general is built around flights, the SCS message follows the conventional format of first identifying the flight that owns the slot, then the additional data needed to process the message. This message also deviates in that it is a fixed format. Because of this, no field identifiers are used.

An SCS message has the following format. The first field defines the message type. The next four fields uniquely identify the flight that is currently in the slot being yielded. The remaining fields provide, in order, the name of the slot being yielded, the earliest acceptable time for the new slot, and the latest acceptable time for the new slot.

A sample SC message for a GDP follows:

```
SCS UNA1277 DFW SFO 03241701 SFO.242040A 242050 242120
```

This sample would be interpreted as follows:

- SCS – This is an SCS request message type. (Required)
- UNA1277 – The ID of the flight to be subbed into the new slot. (Required)
- DFW – The origin of the flight. (Required)
- SFO – The destination of the flight. (Required)
- 03241701 – The original departure date/time for the flight. (Required)
- SFO.242040A – The yielded slot. (Required)
- 242050 – The earliest acceptable time for the new slot. (Required)
- 242120 – The latest acceptable time for the new slot. (Required)

A sample SC message for an AFP follows:

```
SCS UNA1277 DFW SFO 03241701 FCA002.242040A 242050 242120
```

4.2.4 SC Message

The SC message is used to create a slot for an existing un-controlled flight. The first field defines the message type. The next four fields uniquely identify the flight that is being modified. The remaining fields provide the CTD, CTA, and arrival slot for the flight.

A sample SC message for a GDP has the following format:

```
SC ABC999 STL LGA 06260315 T5 260328 T6 260552 A2 LGA.260552Q
```

The sample message has the following meaning:

- SC – Message type. (Required)
- ABC999 – Flight identifier (a.k.a. call sign) of the flight being modified. (Required)
- STL – Origin airport for the flight. (Required)
- LGA – Destination airport for the flight. (Required)

06260315 – Original gate departure date and time for the flight (0315Z on June 26th). (Required)

T5 – Field identifier for CTD. (Required)

260328 – New value of CTD requested for this flight (0328Z on the 26th). (Required)

T6 – Field identifier for CTA. (Required)

260552 – New value of CTA requested for this flight (0552Z on the 26th). (Required)

A2 – Field identifier for assigned arrival slot. (Required)

LGA.260552Q – Name of arrival slot requested for this flight. (NOTE: ETMS creates suffixes using the early part of the alphabet and also uses Z. By choosing a suffix that is later in the alphabet but not Z, the user increases the changes that the slot name will be unique.) (Required)

A sample SC message for an AFP has the following format:

```
SC ABC999 STL LGA 06260315 T5 260328 T6 260552 A2 LGA.260552Q
```

A detailed description of each field format is provided in section 4.2.9.

4.2.5 *Hold All Slots*

The HOLD ALL SLOTS message holds all open slots belonging to a user for a particular GDP.

A sample message has the following format:

```
HOLD ALL SLOTS FOR LGA
```

4.2.6 *Release All Slots*

The RELEASE ALL SLOTS message releases all open slots belonging to a user for a particular GDP.

A sample message has the following format:

```
RELEASE ALL SLOTS FOR FCA002
```

4.2.7 *Bridging Off*

The Bridging Off message temporarily disables flights for the sending user from being used as part of an SCS bridge in a particular GDP.

A sample message has the following format:

```
EDCT BRIDGING OFF LGA
```

4.2.8 *Bridging On*

The Bridging On message restores the use of flights for the sending user from being used as part of an SCS bridge in a particular GDP.

A sample message has the following format:

```
EDCT BRIDGING ON FCA002
```

4.2.9 *Message Field Descriptions*

Following are detailed descriptions of each field used in the FM, FX, and SC messages. Each description includes:

- Field number
 - Field name
 - Format defined as the field length and composition. The composition shows how many and what kinds of symbols are allowed. Symbols shown outside of parentheses are required. Symbols shown inside parentheses are optional. The following conventions are used in the composition:
 - L – uppercase letter (A-Z)
 - a – any uppercase letter or digit (A-Z, 0-9)
 - d - any digit (0-9)
 - () – parentheses indicate optional characters.
- Example: Ld(a)(a) means that the field must start with an uppercase letter followed by a number, optionally followed by one or two characters that are either letters or numbers.
- Examples.
 - A paragraph describing the field.

The message fields follow.

Field 02. Flight Identification — 2–7 characters. La(a)(a)(a)(a)

Examples: N1, GAA1234

Flight call sign as it appears in the OAG and/or is filed on the NAS flight plan. No padding is required. Do not include a space between the user code and the flight number.

Field 26. Departure Airport — 3-4 characters. aaa(a)

Examples: JFK, CYYZ

FAA identifier for the airport of origin for this flight.

Field 27. Arrival Airport — 3-4 characters. aaa(a)

Examples: JFK, CYYZ

FAA identifier for the destination airport for this flight.

Field A1. Original Gate Departure Date and Time — 8 digits. dddddd

Example: 06261225

Month, day, hour and minute on which the flight leg was originally scheduled to depart the gate. Month, day, hours and minutes must each be two digits, zero padded.

Field A2. Assigned Arrival Slot — 11,12, or 14 characters. (L)LLL.dddddL or FCAdd.dddddL

Example: ORD.261200A, CYYZ.261200C, FCA002.191435A

Unique identifier of the arrival slot to which this flight is currently assigned. The format is a concatenation of airport or FCA name, slot date and time, and a one-letter suffix. An airport name can be three or four characters. An FCA name must be “FCA” followed by three digits. The slot date and time is six

digits: two each for day, hour, and minute. Day, hour, or minute should be zero padded if necessary (e.g., 06). The suffix letter is used to ensure that slot name is unique.

Field A6. Slot Hold Flag — 1 character. L

Examples: H, R

Value of the hold flag; H means slot is held, R means slot is released. Only valid if the slot is currently occupied by a cancelled flight.

Field T5. Controlled Time of Departure (CTD) — 6 digits. dddddd

Example: 261245

Day, hour, and minute at which the flight will have to leave the departure runway to make its controlled arrival time. Also referred to as EDCT. Format is six digits: two each for day, hour, and minute. Day, hour, or minute should be zero padded if necessary (e.g., 06).

Field T6. Controlled Time of Arrival (CTA) — 6 digits. Dddddd

Example: 261553

Day, hour, and minute at which the flight must arrive to make its arrival slot. For a GDP or GS, the CTA is the arrival time at the airport; for an AFP, the CTA is the arrival time at the FCA. Format is six digits: two each for day, hour, and minute. Day, hour, or minute should be zero padded if necessary (e.g., 06).

Field T8. Earliest Runway Time of Arrival (ERTA) — 6 digits. Dddddd

Example: 261518

Day, hour, and minute of the earliest runway arrival time that a user is willing to accept for a flight. Format is six digits: two each for day, hour, and minute. Day, hour, or minute should be zero padded if necessary (e.g., 06).

4.3 Substitution Message Replies

ETMS will send a response to every SS message packet. The response is by default sent to the return address on the incoming message. (The user can optionally request that the response for a CDMNET message be sent to an ARINC address.) The format of the response is the same regardless of what types of messages were sent in the SS packet.

4.3.1 Good Response

If no errors are detected in the SS packet, the ETMS database is updated to reflect the changes requested by the users. The response to the user includes the packet identifier, a message indicating it was successfully processed, and an updated slot list for each flight affected by the message.

A good response to the sample packet from section 2 has the following format:

```
SS ABC0625121029.01 ACCEPTED.
SLOT LIST for LGA
```

ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	ERTA	IGTD
ABC1234	LGA.260500A	DCA	LGA	260400	260500	SUB	-	Y	-	-	260145
ABC5678	LGA.260400A	IAD	LGA	260300	260400	SUB	-	-	-	260400	260245

The meaning of the sample response is as follows:

Line 1: Shows the identifier of the packet that is being replied to. The word “ACCEPTED” indicates that the processing of the packet was successful.

Line 2: Identifies airport that the SS messages were for.

Line 3: blank

Line 4: Column headers for the slot list.

Lines 5 – n: A slot list for all flights affected by the SS messages. The format is the same as described in section 1.

4.3.2 Error Response

If errors are detected in the SS packet, the entire packet is rejected and the ETMS database is not updated. The response to the user includes the packet identifier, a message indicating it was rejected, and the number of errors. For each error, the response shows the SS message that triggered the error and the reason for the error.

A sample error response has the following format:

```
SS ABC0625121029.01 REJECTED. 1 ERROR.

FM ABC1234 DCA LGA 06260145 T5 260400 T6 260430 A2 LGA.260500A
ERR501: CTA NOT WITHIN 20-MINUTE WINDOW
```

The meaning of the sample response is as follows:

Line 1: Shows the identifier of the packet that is being replied to. The word “REJECTED” indicates that the processing of the packet was successful. The number of errors is shown.

Line 2: blank

Line 3: The SS message that triggered the error.

Line 4: The error code and message. In this case the CTA provided in the T6 field was not within 20 minutes of the slot time shown in the A2 field.

A complete list of the error messages is shown in Appendix A.

5. TERMINATING A GDP OR AFP

When a GDP or AFP is terminated (also referred to as purged), meaning that the remaining controls for that ADP/GDP are being removed, a message is sent to the user notifying them of the purge. In the case of an airport GDP, it is straightforward for the user to know which flights are no longer controlled. In the case of an AFP, the affected flights might have different origins or destinations and otherwise be hard to determine. To remove any ambiguity over which flights are being purged, the purge message will include a list of the flights that no longer are considered

controlled by ETMS. Although the motivation is clarity in an AFP, the same format is used for either an AFP or GDP for consistency. The format of the purge message is described in section 7.2.

NOTE: Any flights that have departed prior to the GDP or AFP being purged will NOT be included in this list. Since the CTD was in place when these flights departed, ETMS considers them already controlled and so therefore will not purge them.

6. REPORTS

Three reports are available to the user through the SS process. Report requests must be transmitted to the Air Traffic Control System Command Center (ATCSCC) ARINC address TFMBSYA or over the CDMNET via TCP/IP socket.

6.1 Report Requests

When sending a report request over ARINC/ADNS, the request must include the “RQ” packet header. When sending report requests over CDMNET, no header is required or allowed.

A sample report request has the following format:

```
RQ
EDCT LIST
EDCT SUB SHOW
EDCT SLIST LGA
```

Line 1: Packet header: the letters “RQ”. No packet identifier is required. Only required and allowed for ARINC/ADNS messages.

Line 2 - n: Report request(s). The packet can include one or more requests. Each report comes back as a separate message. Possible request types are:

EDCT LIST – Returns a list of all airports that currently have GDPs.

EDCT SUB SHOW – Returns the substitution status (on or off) at all airports that currently have GDPs (sub status is also part of the EDCT LIST report).

EDCT SLIST LGA– Returns a slot list for the requested airport or FCA. Like the slot lists sent when the GDP is issued, the EDCT SLIST report returns a single list that includes all flights affiliated with the requesting user. That is, the reply can include different three-letter user codes in one report.

6.2 Report Formats

6.2.1 EDCT LIST

A sample EDCT LIST report has the following format:

Number of airports currently controlled: 3

DEST	TIMES	CONTROL	FLIGHTS	SUBS	SCS
EWR	/19/01/	EDCT+DAS	255	ON	ON
JFK	/20/23/	GS	47	OFF	OFF

Bridging status at EWR:

- Carriers which turned bridging OFF:

USA

Bridging status at JFK: ON.

Number of FCAs currently controlled: 1

FCA	TIMES	CONTROL	FLIGHTS	SUBS	SCS
FCA002	/18/23/	EDCT+DAS	24	ON	ON

Bridging status at FCA002: ON.

Bridging turned OFF permanently for non-CDM general aviation and military.

Printer: \$fsa.//wkstn32

The meaning of the sample is as follows:

Line 1: The number of airports that currently have GDPs or ground stops.

Line 2: blank

Line 3: Column headers

Line 4: separator

Lines 5 – 8: A list of each issuance of a GDP or ground stop that are currently in effect. Each line indicates (using line 5 as an example)

Airport name (EWR)

Start and end times of the GDP or ground stop (1800Z to 2300Z)

Types of controls issued (EDCTs and DAS delays)

Number of flights affected (44)

Status of substitutions (ON)

Status of Slot Credit Substitutions (ON)

Line 9: blank

Lines 10 – 14: Status of bridging for individual GDPs. If bridging is off, the report lists each carrier that currently has bridging off for that GDP.

Line 15: blank

Line 16: Number of controlled FCAs.

Line 17: blank

Line 18: Column headers

Line 19: separator

Line 20: A list of each issuance of an AFP that is currently in effect. The format is the same as for the GDP list.

Line 21: blank

Line 22: Status of bridging for individual AFPs. Same format as for GDPs.

Line 23: blank

Line 24: Status of bridging for the system. This applies to both GDPs and AFPs. (NOTE: This line continues out past the right margin.)

Line 25: blank

Line 26: Location of the printer at the command center. (NOTE: This is of no use for the NAS user.)

If a GDP or AFP has been revised or compressed, there will be multiple lines for that airport or FCA. The number of flights in any line shows the number of flights controlled by that issuance that were not later updated in the next issuance. Thus, the total number of affected flights is the sum of these numbers (for EWR, 255+44 = 299 flights currently affected).

6.2.2 EDCT SUB SHOW

A sample EDCT SUB SHOW report has the following format:

```
Current Time: 18:06:17 on 7/29/2005

Airport      SUB Processing Activated  SCS Processing Activated
EWR          Yes                        Yes
JFK          No                         No

Bridging status at EWR:
- Carriers which turned bridging OFF:
  USA
Bridging status at LGA: ON.
Bridging status at JFK: ON.

FCA          SUB Processing Activated  SCS Processing Activated
FCA002       Yes                        Yes

Bridging status at FCA002: ON.

Bridging turned OFF permanently for non-CDM general aviation ...

Printer:  $fsa.//wkstn32
```

The meaning of the sample is as follows:

Line 1: Time and date the report was generated.

Line 2: blank

Line 3: Airport header

Line 4 – 6: A list of each GDP airport and the status of substitutions at that airport.

Line 7: Blank

Lines 8 – 12: Status of bridging for individual GDPs. If bridging is off, the report lists each carrier that currently has bridging off for that GDP.

Line 13: Blank

Line 14: FCA header

Line 15: A list of each AFP FCA and the status of substitutions at that FCA.

Line 16: Blank

Lines 17: Status of bridging for individual AFPs. Same format as for GDPs.

Line 18: blank

Line 19: Status of bridging for the system. This applies to both GDPs and AFPs. (NOTE: This line continues out past the right margin.)

Line 20: blank

Line 21: Location of the printer at the command center. (NOTE: This is of no use for the NAS user.)

The data shown in the EDCT SUB SHOW report is the same as the data shown in the SUBS column of the EDCT LIST report.

6.2.3 EDCT SLIST

The EDCT SLIST request returns the same format used to issue a GDP, or used to reply to an SS message. The only difference with the GDP issuance is the first line. As with the slot list issued for a GDP or AFP, the line length presents a problem for ARINC/ADNS. The same solution is applied here; that is, a report requested over CDMNET will contain the full data while a report request over ARINC/ADNS will contain truncated data.

Sample reports are shown here. Refer to section 3 for a full description of the slot list format.

A sample full EDCT SLIST report to be sent over CDMNET for a GDP has the following format:

SLOT LIST FOR LGA											
ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	ERTA	IGTD
ABC1234	LGA.260400A	DCA	LGA	260300	260400	GDP	-	-	-	260400	260245
ABC5678	LGA.260500A	IAD	LGA	260400	260500	GDP	-	-	-	260300	260145
ABC3601	LGA.260323A	BOS	LGA	260206	260323	GDP	Y	-	-	260319	260150
ABC3522	LGA.260311A	DCA	LGA	260215	260311	GDP	-	-	-	260311	260145
ABC3994	LGA.260353A	ROC	LGA	260246	260353	GDP	-	Y	-	260355	260235

A sample truncated EDCT SLIST report to be sent over ARINC/ADNS for an AFP has the following format:

SLOT LIST FOR FCA002										
ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	IGTD	
ABC1234	FCA002.260400A	DCA	LGA	260300	260400	AFP	-	-	260245	
ABC5678	FCA002.260500A	IAD	BOS	260400	260500	AFP	-	-	260145	
ABC3601	FCA002.260323A	BOS	LGA	260206	260323	AFP	Y	-	260150	
ABC3522	FCA002.260311A	DCA	BOS	260215	260311	AFP	-	-	260145	
ABC3994	FCA002.260353A	ROC	LGA	260246	260353	AFP	-	Y	260235	

7. UNSOLICITED MESSAGES

During a GDP or AFP, ETMS will send messages to the users when changes are made in the ETMS database that affect that user's flights. These messages can be sent to ARINC addresses provided by the user or over CDMNET via TCP/IP socket.

NOTE: All examples in this section are shown using the full format as sent over AOCNET. When sent over ARINC, the slot list format is truncated as for any other slot list issuance.

7.1 Substitution Status

A message is sent whenever the FAA turns the substitution processing on or off at an airport. User substitution messages are rejected when substitutions are turned off. This is typically done just before a GDP or AFP is revised so that the ETMS and user databases will stay synchronized. A sample of each type follows:

```
EDCT SUB OFF LGA
```

```
EDCT SUB ON FCA002
```

7.2 GDP Termination

The FAA terminates a GDP by using an EDCT PURGE command to clear the controls out of the ETMS database. The user will get a copy of the EDCT PURGE commands. The purge message will include a list of all flights that are no longer considered controlled due to this purge. A sample EDCT PURGE follows:

```
EDCT PURGE FCA002
```

ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	EENTRY	IGTD
ABC1234	FCA002.260400A	DCA	LGA	260300	260400	AFP	-	-	-	260400	260245
ABC5678	FCA002.260500A	IAD	BOS	260400	260500	AFP	-	-	-	260300	260145
ABC3601	FCA002.260323A	BOS	LGA	260206	260323	AFP	Y	-	-	260319	260150
ABC3522	FCA002.260311A	DCA	MHT	260215	260311	AFP	-	-	-	260311	260145
ABC3994	FCA002.260353A	ROC	LGA	260246	260353	AFP	-	Y	-	260355	260235

7.3 EDCT Update

The FAA can manually update the data for a controlled flight using an internal command called EDCT UPDATE. The user will get a message whenever EDCT UPDATE is used to modify one of its flights (including affiliated users). The update is simply a new slot list including the one flight that was changed by FAA.

NOTE: When ETMS creates a slot for a flight in response to a EDCT UPDATE request from FAA, it uses a letter suffix of "P" or later to ensure that the slot name will not conflict with a slot name created by FSM. FSM assigns suffixes starting with the letter "A". Unique slot names are required to allow these flights to be substituted.

A sample EDCT UPDATE message has the following format:

```
EDCT UPDATE FOR LGA
```

ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	ERTA	IGTD
ABC1593	LGA.252100P	ORD	LGA	251641	252100	UPD	-	-	-	252034	251623

7.4 DAS Delay

The user will get this message whenever a DAS delay is applied to one of its flights. The update is simply a new slot list including the one flight that was changed by FAA.

NOTE: When ETMS creates a slot by assigning a DAS-delay to a pop-up, it uses a letter suffix of "Z" in the slot name. "Z" slots are not assured to be unique. Since a DAS-delayed flight cannot be used in substitutions, the slot name is not required to be unique.

A sample EDCT UPDATE message for a user has the following format:

```
DAS DELAY FOR FCA002

ACID      ASLOT          DEP ARR   CTD     CTA     TYPE EX CX SH EENTRY IGTD
ABC1593 FCA002.252100Z ORD LGA  251641 252100 DAS  -  -  -   252034 251623
```

7.5 GAAP Slot Assignment

The user will get this message whenever a GAAP unassigned slot is applied to one of its flights. The update is simply a new slot list including the one flight that was assigned to the slot.

A sample GAAP SLOT message for a user has the following format:

```
GAAP SLOT FOR LGA

ACID      ASLOT          DEP ARR   CTD     CTA     TYPE EX CX SH ERTA  IGTD
ABC1593 LGA.252100A ORD LGA  251641 252100 GAAP -  -  -   252034 251623
```

7.6 SCS Bridging Update

The user will get this message whenever one or more of its flights is used to create a bridge for an SCS request. A bridging update will only move a flight to an earlier time.

A sample BRIDGING UPDATE message for a user has the following format:

```
SCS BRIDGING UPDATE FOR FCA002

ACID      ASLOT          DEP ARR   CTD     CTA     TYPE EX CX SH EENTRY IGTD
ABC1593 FCA002.252100A ORD LGA  251641 252100 BRG  -  -  -   252034 251623
```

7.7 ECR Update

When a flight misses its EDCT window, the FAA will request a new EDCT for that flight using the ECR Tool. The ECR Tool allows the traffic manager to first make an SCS request. If that fails, the traffic manager can then make an EDCT Update request. An ECR-generated EDCT Update request looks like any other EDCT Update; the user is notified as described in section 7.3. An ECR-generated SCS request, if successful, will look slightly different to the user. The message sent will have the same header as the SCS Bridging Update. However, the flight for which the EDCT change was requested will have a control type of ECR. The slot list may also include flights for that user that were bridged as part of the request.

A sample SCS BRIDGING UPDATE message that includes an ECR flight has the following format:

SCS BRIDGING UPDATE FOR LGA

ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	ERTA	IGTD
ABC1593	LGA.252100A	ORD	LGA	251641	252100	ECR	-	-	-	252034	251623
ABC264	LGA.252043B	DFW	LGA	251737	252043	BRG	-	-	-	252043	251705

7.8 SCS Status

A message is sent whenever the FAA turns the SCS processing on or off at an airport. User SCS messages are rejected when SCS is turned off. The capability to turn off SCS was implemented as a fail-safe in case SCS messages caused adverse effects during a GDP or AFP. It is never used under normal circumstances. A sample of each type follows:

EDCT SCS OFF LGA

EDCT SCS ON LGA

7.9 Drop-out Flight

When a flight drops out of an FCA, perhaps due to a reroute, and therefore is no longer controlled by an AFP for that FCA, a message will be sent to the user indicating that the flight is no longer controlled. The message shows the control times and slot at the time the flight was rerouted.

NOTE: Once a flight drops-out of an AFP, the slot that belonged to that flight is no longer available for substitution or compression. See section 4.1.4 for more details.

A sample DROPOUT FLIGHT message for a user has the following format:

DROPOUT FLIGHT FOR FCA002

ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	EENTRY	IGTD
ABC1593	FCA002.252100A	ORD	LGA	251830	252100	AFP	Y	-	-	252034	251623

7.10 Re-control

There are two cases, other than the issuing of a GDP or AFP, in which the control of a flight might transfer from one AFP to another:

- A flight might drop out of one AFP and immediately be eligible for another.
- The controlling program for a flight may be purged, making it eligible for another AFP.

In either case, a message will first be sent to the user indicating that the flight is no longer controlled by the original AFP or GDP, followed by another message indicating the flight is now controlled by a new element. If the flight was a pop-up in the prior AFP or GDP, the user will receive a new pop-up message as described in section 7.4. However, if the flight was not a pop-up and could be subbed in the prior GDP or AFP, a RECONTROL message will be sent, indicating that the flight can be subbed in the new program. The flight will be assigned a control type of "RCTL".

NOTE: When ETMS creates a slot for a re-controlled flight, it uses a letter suffix of "P" or later to ensure that the slot name will not conflict with a slot name created by FSM. FSM assigns suffixes starting with the letter "A". Unique slot names are required to allow these flights to be substituted.

A sample RECONTROL FLIGHT message for a user has the following format:

RECONTROL FOR FCA002

ACID	ASLOT	DEP	ARR	CTD	CTA	TYPE	EX	CX	SH	EENTRY	IGTD
ABC1593	FCA002.252100P	ORD	LGA	251830	252100	RCTL	Y	-	-	252034	251623

8. COMMUNICATIONS PROTOCOLS

8.1 ARINC/ADNS

The ARINC/ADNS network provides users with a customized network for transmitting and receiving certain aviation data. The GDP and AFP messages are sent and received using the same protocol as other ADNS data. The only specific requirement of the GDP and AFP messages is that they be sent with a priority of “QU”.

To help illustrate the protocol format, here is the sample SS packet from section 2 as it appears when sent over ARINC/ADNS:

```
QU TFMBSYA
.SUBHQAB
SS ABC0626021029.01
FX ABC1234 DCA LGA 06260145
FM ABC1234 DCA LGA 06260145 T5 260400 T6 260500 A2 LGA.260500A
FM ABC5678 IAD LGA 06260245 T5 260300 T6 260400 A2 LGA.260400A
```

The meaning of the sample is as follows:

Line 1: Shows the message priority (QU) and the FAA address to which the messages must be sent (TFMBSYA).

Line 2: Shows the return address of the sending user. In some cases, a time stamp follows the return address. This is allowed but not required.

Lines 3 – n: The content of the SS packet.

NOTES:

- ARINC/ADNS limits line lengths to 68 characters. An SS message can be continued to another line by using a hyphen (-) as the last field in the first line.
- ARINC/ADNS message packet size is limited to approximately 1800 bytes.

8.2 CDMNET

CDMNET is a private, dedicated communications network based on TCP/IP protocol used to provide secure, reliable, high-speed communications between users and ETMS. Several vendors provide connectivity to CDMNET offering different levels of service to the users. If a user chooses to use CDMNET, it is incumbent on the user to develop or procure software that adheres to the protocol described here.

8.2.1 Session Protocol

Using CDMNET, inter-process communications between application processes at the users and the ETMS are performed in “sessions” through dedicated TCP/IP sockets. In each session, the application running at the user site is considered the client and the application running at the ETMS is considered the server. The approach is as follows:

- A client process opens a socket connection to a server process using an FAA-provided IP address and starts a session.

- Data is exchanged between the client and server indefinitely.
- The client terminates the session by closing the connection. (NOTE: Under error conditions the server can also close the connection and end the session.)

When the connection is opened, the ETMS server uses the IP address to validate that the connection is coming from an allowed client. The client begins the session either by sending a “connect” message, or by sending any other type of GDP or AFP message. Each message has a *client tag* embedded in the header. The ETMS server validates the client tag against the sending IP address to help ensure that the data is coming from the authorized client and to identify which user is sending the data.

The user client can manage the session in several ways. If the user wants to get unsolicited GDP and AFP messages, the client should establish a connection, send a connect message (to identify itself), and listen on the socket indefinitely. If the user does not want to get the unsolicited messages, the client can connect when it has a message to send, wait for the reply, then disconnect.

If a user wants to run multiple simultaneous clients, the user needs a unique client tag for each. FAA will provide as many client tags as the user needs. FAA can authorize use of the client tags from a single IP address or multiple addresses.

ETMS provides multiple servers for added reliability. Airport client software should have the capability of connecting to more than one server address.

In the case that the ETMS server has data to transmit to a user and the user client is not currently connected, the ETMS server discards the data. When a user client reconnects, it can use the reports requests to synchronize the user with the current ETMS data, if desired.

8.2.2 Message Protocol

All messages sent over CDMNET are comprised of a 24-byte binary header, followed in most cases by a variable number of bytes containing application-specific data; for example, a slot list, an SS packet, or a report request. The 24-byte header is comprised of six 4-byte integers, defined as follows:

- | | |
|--------------------------|--|
| 1) Message Type - | Integer value of the message type. [4-byte integer] |
| 2) Message Source - | Not used for this application. Should always be 0. [4-byte integer] |
| 3) Message Destination - | Not used for this application. Should always be 0. [4-byte integer] |
| 4) Client Tag - | The client tag assigned by the FAA for use by the user. [4-byte integer] |
| 5) Short Data - | Field for optional use by the user as a sequence number or message identifier. If this field is filled on an SS message or a GDP request, the value will be inserted in this same field on the corresponding reply. [4-byte integer] |
| 6) Message Length - | Length of the data buffer to follow (may be zero; maximum is 128 Kbytes). [4-byte integer] |

7) Data Buffer -

An array of ASCII bytes, the size of which is defined by the Message Length field, containing the application message (e.g., "EDCT LIST") It may only sent if the Length field in the header is non-zero. Maximum size is 128 Kbytes.

The message types that are used for GDP data are defined in the following table:

Message Type Name	Integer Value	Use	Data Buffer Content
M_ATMS_CONNECT	1	Sent by client when first connecting to identify itself to the ETMS server.	There is no data buffer for this message.
M_ATMS_ACCEPT	2	Set by ETMS server to client to acknowledge that the connection as been accepted.	There is no data buffer for this message.
M_ATMS_REJECT	5	Sent by ETMS server to client to notify the client that the connection has been refused.	There is no data buffer for this message.
M_HB_REQ	10	Optionally sent by client to check if the connection is still alive.	There is no data buffer for this message.
M_HB_ACK	11	Sent by the ETMS server to the client in response to a M_HB_REQ	There is no data buffer for this message.
M_SS_DATA_PACKET	112	Sent by client to submit a substitution request.	SS packet as described in Section 2.
M_SS_REPLY	102	Sent by ETMS server in response to a substitution request.	SS Reply as described in Section 2.3.
M_SLOT_DATA	103	Sent by ETMS server when a GDP is issued; includes initial GDP, compression, revision, extension, blanket, or ground stop.	Slot list as described in section 1.
M_GDP_REQ	104	Sent by user client to request one or more reports.	Report request (EDCT LIST, EDCT SUB SHOW, or EDCT SLIT) as described in Section 4.1.
M_GDP_REPLY	105	Sent by ETMS server in response to a report request.	Report (EDCT LIST, EDCT SUB SHOW, or EDCT SLIT) as described in Section 4.2.

Message Type Name	Integer Value	Use	Data Buffer Content
M_GDP_MESSAGE	106	Sent by ETMS server when triggered by certain events during a GDP.	Unsolicited messages (EDCT PURGE, EDCT SUB ON/OFF, EDCT UPDATE, DAS DELAY) as described in section 4.

An example of a client message follows. Back-slashes are used to delineate the start and end of the message. Numbers in angle brackets are four-byte binary integers. Plain characters are ASCII text. <NL> is used to represent the newline character.

```
\<104><0><0><383><1><9>EDCT LIST\
```

This example should be interpreted as follows:

<104> - Message type M_GDP_REQ

<0> - Ignored

<0> - Ignored

<383> - Client tag assigned by FAA for this client

<101> - Request identifier filled in by the client.

<9> - Number of ASCII bytes to follow.

‘EDCT LIST’ – The 9 ASCII bytes that contain the report request.

A sample reply to this message is:

```
\<105><0><0><383><1><174>Number of airports currently
controlled: 1<NL><NL>DEST    TIMES    CONTROL    FLIGHTS
SUBS<NL>-----<NL>EWR
/18/23/  EDCT+DAS    44    ON\
```

This example should be interpreted as follows:

<105> - Message type M_GDP_REPLY

<0> - Ignored

<0> - Ignored

<383> - Client tag assigned by FAA for this client

<101> - The short data field copied from the client request.

<174> - Number of ASCII bytes to follow.

‘Number of airports...’ – The 174 ASCII bytes that contain the report.

8.2.3 Error Handling

Loss of Client

When the ETMS server detects a loss of client, it ends the session by closing the connection. It is the responsibility of the client to reestablish the connection. The server considers any of the following events to be a “loss of client”.

- Notification that the socket connection to the client has been lost

- A failure when writing to the client socket.

Loss of Server

When a client detects a loss of server, it should end the session by closing the connection, notifies the user as appropriate, and tries to re-establish a new connection. A client considers any of the following events to be a “loss of server”.

- Notification that the socket connection to the server has been lost
- A failure when writing to the server socket.

9. BECOMING A PARTICIPANT

Before a user can participate in substitutions, the user must have connectivity to ETMS. This can be done either through the ARINC/ADNS network, through a dedicated IP link, or through a VPN over the Internet; either of the latter two provide the TCP/IP connectivity referred to as the CDMNET. Information for accessing the CDMNET will be provided upon request.

NOTE: In order to use Flight Schedule Monitor (FSM) tool, a user must have a CDMNET connection.

To participate in substitutions, the user must provide the FAA with the following information:

- All flights codes that you would like to get GDP data for and send SS messages for. These can be specified as:
 - All flights for a three-letter code.
 - Flight number ranges for three-letter codes.
 - A list of specific flight IDs.
- Written authorization from any other users for which you will be doing substitutions.

If the user is using ARINC/ADNS, it must provide to FAA:

- ARINC address(es) that you would like the slot lists sent to when GDPs are issued.
- ARINC address(es) that you would like to be authorized for submitting SS messages.
- ARINC address(es) that you would like to have the unsolicited messages sent to.

If the user is using the CDMNET, it must provide to FAA:

- Apparent IP address (i.e., the address that FAA will see) for any client machines authorized to do substitutions.
- The number of simultaneous clients that the user intends to use operationally.

In addition, if the user is using the CDMNET, FAA will provide to the airspace user:

- One or more unique client tags.
- IP addresses and port numbers of the ETMS server.

The FAA can provide access to a test system for users that would like to test the substitution before using it operationally.

To request participation in the substitution process, contact the FAA Air Traffic Control System Command Center (ATCSCC) at the Computer System Analyst (CSA) position. The phone number is (703) 904-4451.

Appendix A. SS ERROR RESPONSES

A.1 Message Validation Errors

The following are general errors in either syntax or semantics that may be detected while parsing the individual SS messages prior to correlating the messages with the ETMS database.

ERR301: UNKNOWN MESSAGE TYPE. USE FC/FM/FX/SM/HOLD ALL SLOTS FOR/RELEASE ALL SLOTS FOR.

A message with an invalid message type was received. Valid message types are FM, FX, SC, HOLD ALL SLOTS, and RELEASE ALL SLOTS.

ERR302: UNKNOWN FORMAT FOR FLIGHT ID.

The flight ID field does not match the specified syntax.

ERR303: UNKNOWN FORMAT FOR AIRPORT.

An airport field does not match the specified syntax.

ERR304: UNKNOWN FORMAT FOR DEPARTURE AIRPORT.

The departure airport field does not match the specified syntax.

ERR305: UNKNOWN FORMAT FOR ARRIVAL AIRPORT.

The arrival airport field does not match the specified syntax.

ERR306: UNKNOWN AIRPORT.

The specified airport does not exist in the ETMS airport database.

ERR307: FLIGHT ID/DEPARTURE/ARRIVAL AIRPORT MISSING.

One of the first three required fields is missing (cannot tell which one from syntax).

ERR308: UTC DEPARTURE DATE/TIME MISSING.

The required field UTC Departure Date/Time is missing.

ERR309: INVALID UTC DEPARTURE DATE/TIME.

The UTC Departure Date/Time contains an illegal value (e.g., a month greater than 12)

ERR310: UNKNOWN FORMAT FOR UTC DEPARTURE DATE.

The UTC Departure Date/Time field does not match the specified syntax.

ERR317: INVALID TIME. USE DDHHMM

A time field contains an illegal value (e.g., date greater than 31)

ERR318: DEPARTURE TIME LATER THAN ARRIVAL TIME.

A departure time cannot be later than an arrival time in a matched pair of times (e.g., control times).

ERR319: DEPARTURE TIME EQUAL TO ARRIVAL TIME.

A departure time cannot be equal to an arrival time in a matched pair of times (e.g., gate times).

ERR320: NOT AUTHORIZED TO UPDATE THIS FLIGHT.

One of the flights in the message belongs to an airline that you can not submit data for.

ERR321: DEPARTURE DATE TOO FAR IN FUTURE.

The departure date is more than 1 day in the future (this limit is temporary until future flights are processed).

ERR323: FIELD SPECIFIED MULTIPLE TIMES.

A field has been defined more than once.

ERR326: FLIGHT ID TOO LONG. USE MAX 7 CHARS.

The Flight ID has 8 characters. Although this is valid CDM message syntax, Flight ID's of 8 characters will not be allowed until NAS goes to 8.

ERR327: LINE CONTINUATION CHARACTER MUST BE LAST FIELD.

A line continuation character (-) was encountered in a position other than the last field in the message.

ERR396: CANNOT SPECIFY CONTROLLED TIME.

Cannot specify CTD or CTA in an FM message submitted in an FD packet. Control times can only be specified in an FM submitted in an SS packet.

ERR397: CANNOT SPECIFY ASSIGNED ARRIVAL SLOT.

Cannot provide Arrival Slot in an FM message submitted in an FD packet. Arrival slot can only be provided in an FM submitted in an SS packet.

ERR398: INVALID CHARACTER.

An unrecognizable character was received in an FC, FM, or FX message.

ERR399: UNKNOWN SYNTAX ERROR.

A totally unrecognizable message was received.

A.2 Packet Header Errors

The following errors may be detected in the packet header line.

ERR402: PACKET ID IS MISSING. USE LLLDDDDDDDDDD.DD

The packet header line does not include a packet ID. A packet ID must be included in any FD or SS packet.

ERR403: INVALID PACKET ID. USE LLLDDDDDDDDDD.DD

The packet ID does not match the specified syntax.

ERR404: NO MESSAGES IN PACKET.

The packet contains no SS messages.

ERR405: UNKNOWN PACKET CODE. USE FD/SS/RQ.

The packet contains an invalid packet code in the header line. Use SS for substitution messages or RQ for substitution report requests submitted over ARINC/ADNS.

ERR406: PACKET CODE LINE MISSING. USE FD LLLDDDDDDDDDDDD.DD

The packet has no header line. For FD packets, use FD followed by a space and the packet ID. For SS packets, use SS followed by a space and the packet ID. For RQ packets, use only the literal string RQ.

ERR407: UNKNOWN HUB SITE ARINC ADDRESS. USE QU BOSCDYA.

The packet was sent to the wrong address.

A.3 SS Error Messages

The following are errors specific to the content of the SS messages.

ERR 412: ILLEGAL HOLD FLAG VALUE: USE R OR H

Valid values for Hold Flag are H to hold slot or R to release slot.

ERR 414: NOT AUTHORIZED TO SUB FOR THESE FLIGHTS

At least one flight in this packet belongs to a carrier for which the sender is not authorized to make substitutions at this airport. Sender must be authorized to submit substitutions for all flights referenced in an SS packet.

ERR415: CANNOT CANCEL A NON-CONTROLLED FLIGHT

An FX message submitted in an SS packet must pertain to a controlled flight. A non-controlled flight may only be cancelled in an FD packet. The most common cause for this error is an incorrect flight ID, origin, destination, or original gate departure date and time.

ERR417: CTA NOT WITHIN 20-MINUTE WINDOW

CTA must be no earlier than the slot time for the flight's assigned slot, and no more than 20 minutes later than the slot time.

ERR418: CANNOT SUB INTO SLOT NOT OWNED BY THIS CARRIER

The FM message references a slot that does not currently belong to the sending user or one of its authorized affiliates.

ERR419: CANNOT SUB TWO FLIGHTS IN ONE SLOT

Packet contains FM messages that assign more than one flight to the same slot. Only one flight may be assigned to a slot.

ERR420: CANNOT SUB ONE FLIGHT IN TWO SLOTS

Packet contains FM messages that assign a flight to more than one slot. A flight may be assigned to only one slot.

ERR421: CANNOT SUB A NON-CONTROLLED FLIGHT

Cannot use an FM message to assign a flight to a slot if the flight does not already have a slot assignment. This message is generated if the flight referenced in an FM does not exist in the ETMS flight database, or if it exists but is not currently controlled. The most common cause for this error is an incorrect flight ID, origin, destination, or original gate departure date and time.

ERR422: CANNOT CONTROL FLIGHT SCHEDULED TO ARRIVE DURING GDP

An SC message can be used to create a slot and assign it to a flight only if the flight is scheduled to arrive after the GDP end time is over.

ERR423: SLOT NOT OWNED BY FLIGHT IN THIS PACKET

In order to preserve the one-flight-one-slot rule, every slot that is assigned in an SS packet must be assigned to another flight in that packet prior to the packet being processed.

ERR424: CANNOT SUB A FORMER POPUP FLIGHT TO A LATER SLOT

To discourage misuse of pop-up flights, a slot created by a pop-up flight cannot be used to improve the position of another flight.

ERR425: AIRPORT OR FCA NOT CONTROLLED

A HOLD ALL SLOTS or RELEASE ALL SLOTS message was received for an airport or FCA that does not currently have a GDP or AFP.

ERR426: CANNOT CHANGE HOLD FLAG FOR NON-CANCELLED FLIGHT

Cannot modify hold flag for flight that does not have an assigned slot in a GDP. The most common cause for this error is an incorrect flight ID, origin, destination, or original gate departure date and time.

ERR427: CANNOT SUB POP-UP FLIGHT

Cannot assign a popup flight to a slot. Only compression may assign a popup to a slot, after which the flight is referred to as a former popup.

ERR428: CONTROL INFO MISSING. SPECIFY: DEP.TIME, ARR.TIME, AND SLOT

CTD, CTA, and ASLOT fields are required in an FM message submitted in an SS packet.

ERR429: SLOT TIME CANNOT BE IN THE PAST

A flight cannot be assigned to a slot whose slot time is earlier than the current time.

ERR430: CANNOT SUB COMPLETED FLIGHT

Cannot modify slot assignment for a completed flight.

ERR431: CANNOT SUB MULTIPLE AIRPORTS OR FCAS

All messages in an SS packet must pertain to flights arriving at the same airport or FCA.

ERR432: CANNOT SEND FC MESSAGE IN SS PACKET

Flights cannot be created in an SS packet. An FC message may only be submitted in an FD packet.

ERR433: SC CAN BE SENT ONLY IN SS PACKET

Slots cannot be created in an FD packet. An SC message may only be submitted in an SS packet.

ERR434: CANNOT CREATE SLOT FOR CONTROLLED FLIGHT

Flight referenced in SC message is already controlled. Cannot use SC message to create a slot and assign a flight to the newly created slot if the flight already has an assigned slot or an DAS Delay.

ERR435: SLOT ALREADY EXISTS

The slot value provided in SC message already exists. A newly created slot must have a unique slot identifier. A user can generally create a unique identifier by changing the suffix letter in the slot name.

ERR436: INVALID MESSAGE TYPE FOR SS PACKET. USE FM/FX/SCS/HOLD ALL SLOTS/RELEASE ALL SLOTS.

Only FM, FX, SCS, HOLD ALL SLOTS or RELEASE ALL SLOTS are valid within an SS packet.

ERR437: SLOT IN SC MSG CANNOT BE DURING CURRENT GDP

Slot time for newly created slot falls in the current GDP timeframe. For a user to create a slot, the slot time portion of the "Assigned Arrival Slot" field in the SC message must specify a time that is after the GDP is over.

ERR438: CANNOT SUB REMOVED FLIGHT

The flight has been removed by the FAA and is not available for subbing.

ERR439: ETE CANNOT BE CHANGED BY MORE THAN 50%

The new ETE, derived by subtracting CTD from CTA, cannot change from the prior ETE by more than 45 minutes or 50% of the prior ETE, whichever is greater.

ERR440: SUB PROCESSING IS OFF

Command Center is currently not accepting substitution messages pertaining to this GDP. FAA will send a SUBS ON message when it resumes accepting substitution messages.

ERR441: SCS CAN ONLY BE INCLUDED IN SS PACKETS

A Slot Credit Sub message can only be included in an SS packet, not in an FD or EI packet.

ERR442: SCS PROCESSING IS OFF

The FAA has turned Slot Credit Sub processing off for the airport or FCA. All SCS requests will be rejected.

ERR443: YIELDED SLOT MUST BE IN THE FUTURE

The slot that is being given up in the SCS message must be later than the current time.

ERR444: EARLIEST ACCEPTABLE TIME MUST BE LATER THAN TIME OF YIELDED SLOT

The time of the yielded slot must be earlier than the earliest acceptable time.

ERR445: EARLIEST ACCEPTABLE TIME MUST BE EARLIER THAN LATEST ACCEPTABLE TIME.

The window of acceptable times must be specified as the earliest acceptable time first then the latest acceptable time.

ERR446: 20-MINUTE WINDOW NOT ALLOWED WITH SCS

The substitution window size for an SCS packet must be set to 0. If any flights within the packet violate the window size, then the packet will be rejected.

ERR447: YIELDED SLOT OWNED BY FORMER POP-UP FLIGHT

The yielded slot must not be owned by a former pop-up.

ERR448: SCS TIME RANGES OVERLAP

The time ranges of different SCS messages within a packet must not overlap. The time range of an SCS is defined as the time from the yielded slot to the latest acceptable time.

ERR449: NO SLOTS AVAILABLE

No bridge could be created that would allow the SCS flight to be moved into the requested window.

ERR450: SLOT TIME OF SCS FLIGHT IS ALREADY WITHIN WINDOW

The yielded slot of the SCS flight already falls within the requested window. No processing is required.

ERR451: SCS PROCESSING HAS BEEN DISABLED UNTIL FURTHER NOTICE

The FAA has suspended SCS processing temporarily.